Dimethylsulfonopropionate as a Reactive Oxygen Species scavenger for phytoplankton cell

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Aim of the project

Context

Dimethylsulfonopropionate (DMSP) and dimethylsulfoxide (DMSO) are the precursors of dimethylsulfide (DMS), a gas that allows the formation of sulphate aerosols impacting on the Earth radiation balance (Fig1). DMS(P,O) are playing several hypothetical roles on phytoplankton cells such as antioxidant, cryoprotectant or osmoregulator.

Goals

- Understand the role of DMS(P,O) as antioxidant for phytoplankton by the impact of light intensity
- Complete the DMS(P,O) cycle
- Validate candidate genes implied in DMS(P,O) production
- Understand the link between ROS production and DMS(P,O) measurements
- Include these results into a biogeochemical model (MIRO)

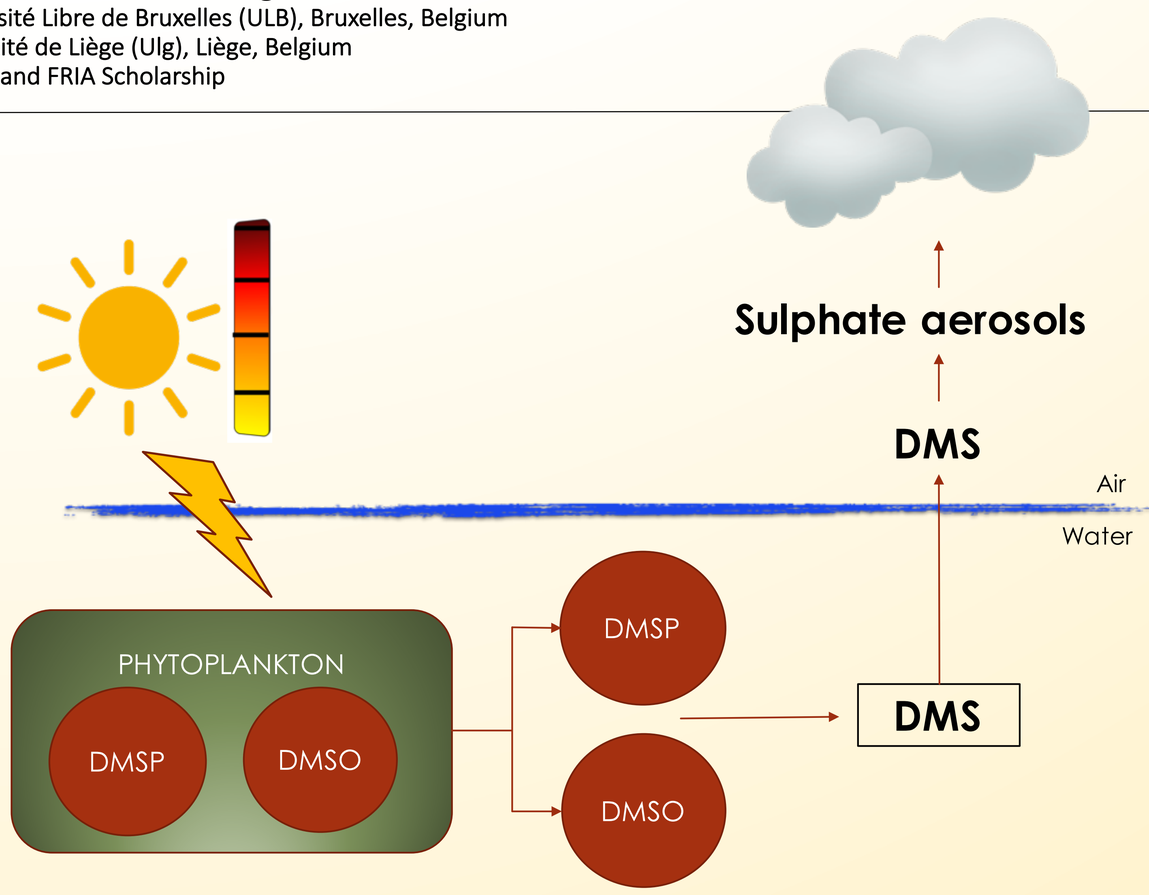


FIG1: DMS(P,O) cycle including exchange between phytoplankton and atmosphere.

Methodology

Experiments

Optimal temperature
& Non limiting nutrients

→ **Effect of light intensity on DMS(P,O) production by ← different key species**

Species

S. costatum

N. closterium

P. globosa

T. pseudonana

Light

(0-1500 µmolq.m^{-2}.s^{-1}+ UV)

At exponential half-growth, we measure
- Density and cellular biovolume
- Fluorescence *in vivo* and Chlorophyll a
- The influence of light intensity on photosynthetic rate
- DMS(P,O) production
- Reactive Oxygen Species (ROS)
- Expression of candidate genes for their synthesis

Field measurements

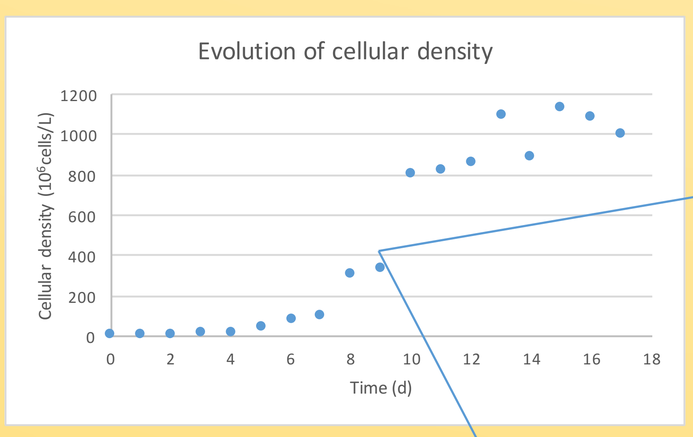
Phytoplankton & bacteria DMS(P,O) measurements

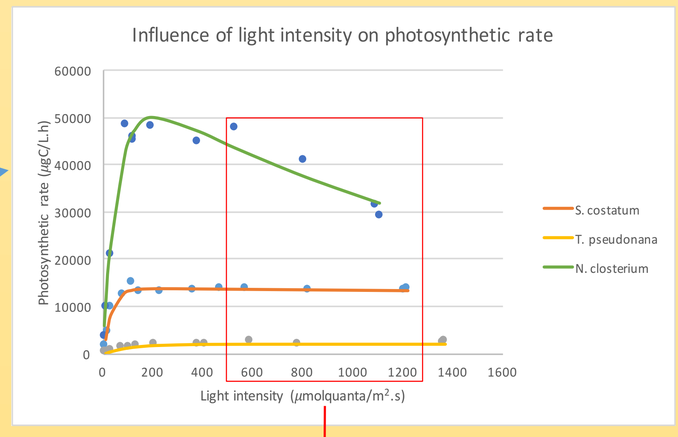
Mathematical Modelisation

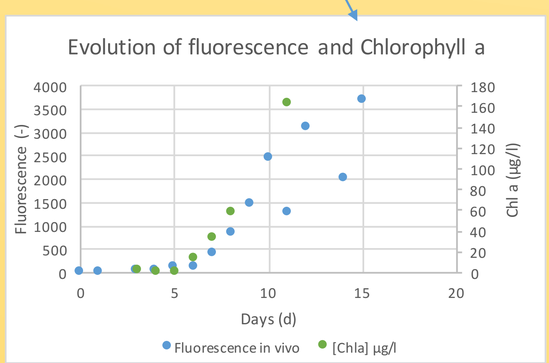
$$\frac{dDMSPp}{dt} = [\mu_n - lysis_n - grazing - sed_n] * SC_n$$

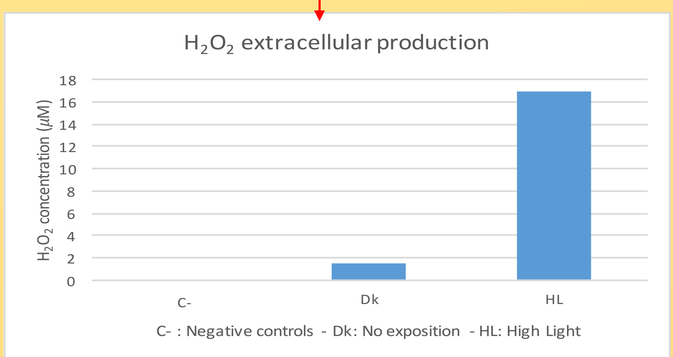
Estimation of current and future DMS emissions

Preliminary Results









When the culture will be on high light intensity, we will measure the oxidative stress with the hydrogen peroxide production as well as the presence of some antioxidant enzymes, compared to the DMS(P,O) production.

We are expecting different results depending on species, and according to the light intensity. Experimental results and field measurements will be included into the biogeochemical MIRO model to better understand the DMS(P,O) cycle and its role on the phytoplankton cell.